September 2006
Status of Science Advisory Board Review of Ecology's Working Definition for Moderate Levels of Arsenic-Contaminated Soils

Background

The Areawide Soil Contamination Task Force submitted their recommendations to the Departments of Agriculture, Community Trade and Economic Development (CTED), Ecology and Health in June 2003. The Task Force provided the agencies with numerous recommendations including several that are related to implementation of the Model Toxics Control Act. In particular, the Task Force recommended that Ecology use an approach to address properties or areas with "low-to-moderate" levels of arsenic and lead that is different than the one used for properties or areas found to have "high" levels of arsenic and lead.

The Task Force did not identify a range of concentrations they considered to be "low-to-moderate". However, concurrent with the Task Force deliberations, Ecology developed a working definition to support ongoing efforts to reduce the potential for children's exposure at schools, child care facilities and other land uses. The working definition includes two parts:

- Schools, childcare centers, and residential land uses: The "low-to-moderate" range includes soils with arsenic concentrations of up to 100 parts per million (ppm) and lead concentrations of up to 500 – 700 ppm.
- Commercial properties, parks, etc (i.e. properties where exposure of children is less likely or less frequent): The "low-to-moderate" range includes soils with arsenic concentrations of up to 200 ppm and lead concentrations of up to 700 – 1,000 ppm.

The Task Force briefly discussed the working definition and agreed with the Ecology's plans to have the SAB review the scientific rationale for the proposed definition.

The Board's review of this issue has been conducted in two phases. In the first phase, the Board addressed the scientific and technical rationale for Ecology's working definition for lead contaminated soils. The Board completed its' review in early 2005 and concluded that the methods and assumptions used by Ecology to establish the working definition for lead-contaminated soils is consistent with current scientific information. However, the Board urged the Department to periodically review the evolving scientific information on the health effects associated with low levels of lead exposure. The second phase of the review focuses on arsenic-contaminated soils. The Board began its' review of Ecology's working definition for arsenic-contaminated soils in early 2005.

Status of Science Advisory Board Response to Ecology Questions

Ecology has asked the Science Advisory Board whether they believe the methods and assumptions used by Ecology to characterize the health risks associated with arsenic-contaminated soils are consistent with current scientific information. To facilitate the Board's consideration of this broad question, the Department posed a series of questions related to particular aspects of this issue. The status of the Board's review is summarized below.

- Cancer Slope Factor: Does the SAB agree with Ecology's conclusion that there is clear and convincing scientific evidence to support the use of an oral slope factor for inorganic arsenic

that is significantly different than the value published in the IRIS database? If yes, does the SAB agree with Ecology's conclusion that slope factors between 3.7 & 23 $(mg/kg/day)^{-1}$ represent a range of scientifically defensible values?

The Board agreed with Ecology's conclusions that there is clear and convincing scientific evidence to support the use of an oral slope factor for inorganic arsenic that is significantly different than the IRIS value and that slope factors between 5.7 and 9.4 $mg/kg/day^{-1}$ represent a range of scientifically defensible values. The Board concluded that they could not determine whether there is a scientific basis for selecting one value or another without additional information on the basis for the two values.

- Chronic Oral Reference Dose: Does the SAB agree with Ecology's conclusion that the chronic oral reference dose (0.0003 mg/kg/day) published in the IRIS database remains an appropriate value for use in evaluating chronic human exposure to soils?

  The Board disagreed with Ecology's conclusion that the chronic oral reference dose published in the IRIS data remains an appropriate value for use in evaluating chronic human exposure to arsenic-contaminated soils. They concluded there is now enough scientific information to consider other non-cancer health endpoints in addition to skin lesions and that the reference dose value (0.00012 mg/kg/day) developed by the California Office of Environmental Health Hazard Assessment appears to be reasonable and consistent with current scientific information.

- Acute Oral Reference Dose: Does the SAB agree with Ecology's conclusion that there is clear and convincing scientific evidence to support the use of an acute reference dose for arsenic that is different than the chronic reference dose published in the IRIS database? If yes, does the SAB agree that a value of 0.005 mg/kg/day is within the range of scientifically defensible values?

  The Board briefly discussed this issue, but concluded that they were unable to fully evaluate this question without considering the results of studies showing increased cancer risks in mice associated with in utero arsenic exposure.

- Incidental Soil Ingestion: Is the assumption that incidental ingestion of soil and dust represents an important exposure pathway for children and adults consistent with current scientific information?

  The Board agreed that Ecology's assumption that incidental ingestion of soil and dust represents an important pathway for children and adults is consistent with current scientific information.

- Dermal Contact: Is the assumption that dermal contact with arsenic-contaminated soils represents an important exposure pathway for children & adults consistent with current scientific information?

  The Board agreed that Ecology's assumption that dermal contact with arsenic-contaminated soils represents an important exposure pathway for children and adults is consistent with current scientific information.

- Inhalation of Re-suspended Soils: Is the assumption that inhalation of wind-blown dust is a minor contributor to overall arsenic exposure consistent with current scientific information?

  - ***The Board agreed that Ecology's assumption that inhalation of wind-blown dust is a minor contributor to overall arsenic is generally consistent with current scientific information.***

    - ***The Board recommended that Ecology consider potential exposure situations where inhalation of re-suspended soils might be an important contributor to overall exposure. In other words, the Board questioned whether the worst-case assumption inherent in Ecology's and EPA models was truly the worst case. They recommended that Ecology consider (1) farm worker exposures and (2) child exposures in residential areas adjacent to farms.***

    - ***The Board recommended that Ecology evaluate the relative contribution of inhalation of finer soil particles compared with ingestion of larger particles that do not reach the lungs (i.e., deposited in the upper respiratory tract and returned to the mouth where they can be swallowed). The Board suggested it would be informative to compare these soil ingestion estimates with the soil ingestion rate (i.e., 200 mg/day) used to estimate exposure via incidental soil and dust ingestion.***

- Homegrown Vegetable Pathway: In evaluating arsenic-contaminated soils, Ecology did not quantify potential exposures resulting from the uptake of arsenic into homegrown vegetables due to uncertainties associated with estimating plant uptake. Is this approach consistent with current scientific information?

  Ecology has concluded that exposure resulting from the consumption of homegrown vegetables grown in arsenic-contaminated soils could represent an important exposure pathway, but did not quantify the potential exposures resulting from this pathway when establishing the working definition for arsenic-contaminated soils. The Board concluded that they were unable to review Ecology's assumption without additional information on sources of uncertainty and variability.

- Exposure Parameters and Assumptions: Are the methods, parameters and assumptions used in estimating exposure to arsenic-contaminated soils consistent with current scientific information?

  The Board discussed the meeting materials for this issue, but did not reach a final conclusion on this question. However, Dr. Norman questioned whether it was reasonable to estimate a lifetime average daily dose using a 6-year exposure duration. She stated that this is problematic because it assumes no additional exposure beyond that exposure period. She also stated that such an approach might be consistent with the current MTCA regulations – but not consistent with current scientific information.

- Ground Water Impacts: Is the assumption that "soils with arsenic concentrations less than 200 mg/kg do not pose a significant threat to ground water" consistent with current scientific information?

  Ecology will distribute additional discussion materials on this issue and this topic will be included on the agenda for the next Board meeting.

- Ecological Protection: Is the assumption that "arsenic concentrations that are protective of human health are also protective of ecological receptors" consistent with current scientific information?

  Ecology will distribute additional discussion materials on this issue and this topic will be included on the agenda for the next Board meeting.

- Future Information Collection and Evaluation Needs: Are there specific information collection and analysis activities that the Board recommends Ecology undertake to address data gaps and uncertainties in the information used to estimate exposure and health risks associated with arsenic-contaminated soils?

Next Steps

- Ecology plans to complete the Board's review and discussion of methods, exposure parameters and assumptions used by Ecology to characterize risks associated with arsenic-contaminated soils by the end of the year.
- Ecology will review the Board's responses to the questions on lead- and arsenic-contaminated soils. Based on that review, Ecology will consider two main questions:
  - Given the Board's responses to Ecology's questions, should the Toxics Cleanup Program consider modifying the overall strategy for addressing area-wide soil contamination?
  - What types of information collection and analysis activities should Ecology undertake in response to the Board's responses?
- The Toxics Cleanup Program plans to consider rule revisions related to implementing the recommendations from Area-wide Soil Contamination Task Force. The Toxics Cleanup Program will consider the results of the Board's review during that process.